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ABSTRACT

Two experiments investigated the relationship between Spanish phonology and Spanish second-language (L2) learners' spelling success. Specifically, they examined: (1) differences in proportions of initial, middle, and final consonants spelled correctly by L2 learners; (2) differences in proportions of initial, middle, and final vowels spelled correctly; and (3) differences in correct spelling of stressed and unstressed syllables. In the first experiment, first-semester college students of Spanish spelled non-words with typical Spanish spelling conventions, all with initial, middle, and final consonants or vowels. Results showed similar proportions of correct spelling of initial and final consonants, but less common correct spelling of the middle consonants. Initial, middle, and final vowels were all correctly spelled with about the same frequency. In the second experiment, students attempted to write non-words with Spanish phonological conventions and place an accent on the appropriate vowel. It was found that phonemes in unstressed syllables tended to be spelled less accurately than those in stressed syllables, and consonant omissions and misspellings outnumbered vowel errors significantly in either stressed or unstressed syllables. It is concluded that Spanish has intrinsic phoneme-grapheme mapping difficulty, with consonants in any position more difficult than vowels to hear and spell. Contains 26 references. (MSE)

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PHONEME-GRAPHEME MAPPING: SERIAL POSITION CURVES AND TONIC PHONEMES IN SPANISH

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PHONEME-GRAPHEME MAPPING: SERIAL POSITION CURVES AND TONIC PHONEMES IN SPANISH

Learning a second language presents unique educational problems, in part because proficient performance requires the mastery of a complex system of communication, within which three areas predominate: speech, writing and paralanguage. Speech and writing, specifically, are physiological and psychological processes fueled by pronunciation, syntax and vocabulary. Furthermore, language instructors are properly concerned with all problems of facilitating student discourse, that is, encoding, decoding and unwrapping linguistic messages (Crookes, 1991; Pica, Kanagy and Falodun, 1993). Spanish orthography poses a special problem for students. To learn to write and spell word-referent pairings, the student must identify the mapping between phonemes and graphemes, that is, the link between the phoneme /e/ and the grapheme e, or the link between /b/ and b. Instructors are also aware that during the phoneme to grapheme process, students encounter a number of difficulties which are caused by predictable factors:

1. When a language learner encounters phonemes that do not fit L1 (English) based schemes, he or she will modify the segmental sounds to mirror the foreign

language or L2 (Slobin, 1969, pp. 61-66).

2. Spanish has audible variants of three occlusive phonemes, /b/, /d/ and /g/. These phonemes occur in complementary distribution because Spanish speakers use them only in an initial position or when they follow /l/ or /n/. The allophones /~~b~~/, /~~d~~/ and /~~g~~/, fricative phonemes, occur in other positions (Kadler, 1970, pp. 127-128.

3. Spanish vowels have the same timbre throughout and do diphthongize. Lip, tongue and soft palate muscles must be exercised to the utmost; vowels require great muscle tension in the front of the mouth cavity. Unstressed (atonic) and stressed (tonic) vowels are identical (Delattre, 1965; Kadler, 1970).

4. Spanish employs phonemic stress to contrast words semantically like está and ésta, yet relative prominence given to syllables, lexical stress, occurs in three distinct degrees: final, penultimate and antepenultimate (Picon Garfield and Schulman, 1991, pp. 19-20).

A central question evolves from these problematic areas. Is spelling accuracy constrained by context or intrinsic difficulties? How do the serial position curve and tonic phonemes operate in L2 learning?

Treiman, Berch and Weatherston (1993) state that a learner's ability to engage in phoneme-grapheme

mapping is a function of both context and the intrinsic difficulty of the correspondence. Their investigation was performed with kindergartners and 1st graders using mono- and bisyllabic nonwords in an American English phonology. The results suggest:

1. Recognition of initial consonants exceed that of final consonants.
2. Final consonants and vowels are statistically indistinguishable.
3. Initial consonants are easier to spell in first syllables.
4. Syllable final consonants are easier to spell in second syllables.
5. Phonemes are spelled more accurately in stressed syllables.
6. Phonemes in the middle of words or syllables are more difficult to spell.
7. Length of word determines spelling accuracy: lengthy words are more difficult to spell.
8. Vowels tend to be more difficult to spell than consonants.

Earlier studies in semantic development prefigure Treiman et al. (1993). Effects of stress and word/ sentence position contribute significantly to segmentation

and mapping (Blasdell and Jensen, 1970; Eilers, 1975) and spontaneous speech (Slobin and Welch, 1971). Slobin (1973) contends that salient final position words suggested from cross-linguistic data are more easily imitated. Kuczaj (1979) contends that suffixes are less difficult to learn than prefixes. Nonetheless, the dearth of experimental research is particularly acute in reference to serial position curves and the segmentation of atonic or tonic phonemes in languages other than English. Although many researchers in the field of phonology are interested in universal processes, the bulk of our knowledge of control and recall of conventional spelling derives from studies of English (Treiman, 1991, 1992; Treiman and Danis, 1988). On the other hand, descriptive segmental features of Spanish words, that is, consonant and vowel phonemes abound and predominate past and current research (Navarro Tomás, 1965; Politzer and Staubach, 1965; Quilis, 1981; Rivers et al., 1988; Rodríguez-Castellano, 1965; Stockwell and Bowen, 1965); these studies do not utilize inferential statistics.

This article proposes that this dominant reliance upon descriptive segmental features in Spanish and upon studies in English not only obscure

our investigations of what L2 learners experience but also when learners discriminate allophones or audible variants of phonemes in words and syllables. The phenomena of stress in words and syllables is not studied in terms of spelling performance using inferential statistics.

The following investigation will attempt to address these questions:

1. Is there a difference between the number of initial, middle and final consonants spelled correctly by L2 learners?
2. Is there a difference between the number of initial, middle and final consonants spelled correctly by L2 learners?
3. Is there a difference between the number of phonemes spelled correctly in stressed (tonic) and unstressed (atonic) syllables?

From the results of these questions, one may hypothesize on the relationship between the intrinsic difficulty and context theories of Spanish phonology, serial position curves and the role of tonic and atonic phonemes on L2 learners (Treiman, 1993; Liberman et al., 1967).

Experiment 1

In the first experiment we examined two questions: (1) Was there a difference between the number of initial, middle and final consonants spelled correctly by L2 learners? and (2) Was there a difference between the number of inital, middle and final vowels spelled correctly by L2 learners? First semester students in elementary Spanish spelled two types of multisyllabic nonwords. Nonwords were selected because graphemic word fragments are very effective cues for recall (see, for example, the experiment described by Tulving, 1976, pp. 52-53). Conventions for Spanish phonology used in this investigation were:

C = single consonants or pr, pl, br, bl, fr, fl, cr, cl, gr, gl, tr, dr.

V = single vowels or diphthongs

$ = syllable boundary

Stimuli for Experiment 1 were: CV$CVC

CVCVCV

VCVCV

VCVCVC

Method

Subjects. The sample used in this investigation included students enrolled in the first semester of college Spanish randomly selected from each class roll; every 3rd member of the list was chosen. Spanish 101A, B and C contributed ten subjects each. Subjects who participated in this study were contacted by letter by the investigator, and informed that normal course assignments and testing would continue; however, during one period after midterm examinations, they would participate in a study of their spelling of Spanish-like words. Further, there would be no penalty for not participating in the study.

Speech sounds receive traditionally great emphasis at the beginning of elementary Spanish; vowels, consonants, semivowels and diphthongs are described and categorized according to their properties. Instructors emphasize manner and points of articulation during both lectures and laboratory sessions. Phonemic difficulties are also corrected through minimal contrastive pairs. Dictation is employed extensively.

Procedure. First, the examiner, a Colombian, held three trials to familiarize subjects with the stimuli. Second, each subject was individually tested with his or her group. The examiner pronounced the non-word twice and

subjects repeated the non-word before attempting to spell it on a pad. Twenty-five nonwords randomized for each subject were on the list. Transposing consonants and vowels (CV > VC) and reversing syllables produced more than twenty unique protocols: no two subjects were examined with the same list. Scoring procedures assigned ten points if subjects spelled initial, middle and final phonemes correctly. Certain adaptations accommodated Spanish phonology, not Spanish orthography.

1. The phoneme /b/ may be spelled b or v in any position.
2. The phoneme /s/ may be spelled s or z + a, i, o, u; c + i, e.
3. The phoneme /x/ may be spelled g + e, i or j.
4. The phoneme /i/ may be spelled i; y may represent final /i/.
5. The graphemes h and ll were not used.

Results

The design of the experiment (consonants) permitted a one-way analysis of variance with categorizing or independent variable levels of initial, middle and final consonants. Means for the consonants were 9.0, 3.0 and 6.0, respectively. The analysis of variance indicated

a significant between groups effect, $F\ (2,27) = 4.50$, $p < .05$; the critical value for alpha = .05 is 3.35. The post hoc multiple comparison test (Tukey) revealed a significant difference between learners spelling middle and final consonants, but no difference between examinees spelling initial and final consonants, $Q\ (3,27) = 3.47$, $p < .05$; the critical value for alpha = .05 is 3.50.

As for the one-way analysis of variance of three independent variable levels, initial, middle and final vowels, the null hypothesis was accepted: there was no significant difference between groups effect, $F\ (2,27) = 1.70$, $p > .05$; the critical value for alpha = .05 is 3.35.

Discussion

Experiment 1 examined the spelling of initial, middle and final consonants and vowels for elementary Spanish students. Representing the Spanish language through orthogonal combinations of consonants and vowels, the investigator constructed more than 20 unique protocols. A total of 25 items were assigned per list. The results indicated that correct spelling of initial and final consonants were not significantly different; middle consonats were, however, more difficult to spell

for Spanish students. There tended to be no significant difference between the correct response rate among initial, middle and final vowels.

The investigator concludes that a serial position curve such that initial and final phonemes are more easily spelled coincides with the left-to-right model of seeing and hearing Spanish phonemes: phonemes and graphemes process from left-to-right with median phoneme-grapheme mapping occupying a difficult serial position. The edges of words form a visual and aural environment of priority. This investigation also suggests that vowels do not pose the same level of difficulty as consonants. By contrast, Spanish exhibits only five vowel, each of which is represented by one phoneme with no significant allophones. Comparing Spanish and Portuguese vowels, Simoes and Kelm (1991) state that Spanish maitains finite quality in its five vowels even if changes in tone and position are present. Such is not the case with the 20 consonant phonemes among which several allophones in complementary distribution exist.

Experiment 1 suggests that Spanish has intrinsic phoneme-grapheme mapping difficulties. Furthermore, Spanish poses several specific problems. Taking a look at the errors among learners, the invesigator found predictably that the allophones of /b/, /d/

/g/ proved difficult for learners. These errors represented 48% of all misspelled consonants. Trilled /rr/ and /r/ were not easily recognized by some subjects. Aural discrimination problems occurred less frequently with other consonants due to their approximate similarity to American English. Therefore, the investigator surmises that the intrinsic difficulty and contest models operate in Spanish phoneme-grapheme mappings.

Experiment 2

In Experiment 2, the researcher examined one question: Was there a difference between phonemes spelled correctly in stressed (tonic) and unstressed (atonic) syllables by L2 learners? Subjects in elementary college Spanish spelled multisyllabic non-words using the conventions established in Experiment 1, and accentuation was added. Stimuli for Experiment 2 were:

CV$CV́

CV$CV́$CV

CV́CVCV

The symbol / ´ / represented stress or loudness of the vowel.

Method

Subjects. Twenty subjects participated in this study: 10

students per group. There participants were randomly selected from class rolls of two sections of beginning Spanish: every 2nd member on the roll was chosen. All students were informed of the research procedure as in Experiment 1. Each subject spelled 10 non-words randomly assigned to twenty unique lists. The participants placed an accent mark upon the stressed or tonic vowel.

Procedure. The examiner, a Dominican, held two trials to familiarize subjects with the stimuli. In the testing phase, students heard each non-word pronounced twice after which the subjects spelled the word and placed an accent mark upon the appropriate vowel. Ten points were assigned to a correct response, zero to incorrect responses. Adaptations to Spanish phonology followed the conventions utilized in Experiment 1.

Results

The design of Experiment 2 permitted a *t*-test of independent samples with categorizing levels of stressed and unstressed syllables. Means for correct spelling of syllables were: 8.0 and 5.0, respectively. The analysis indicated no significant group effect, $t\ (18) = 1.408$, $p > .05$; however, the null hypothesis was rejected at

the .10 level of significance, alpha = .10 is 1.33. The investigator was willing to accept the consequence of a probability that the observed difference between sample means would occur by chance was less than .10.

Discussion

The researcher asked whether differences in stress or accentuation determined how well students spelled correctly within a syllable. The investigation revealed that phonemes in unstressed syllables tended to be spelled less accurately than phonemes in stressed syllables. It must be noted that the significance level had to be elevated to .10 to reach statistical significance.

The number of consonant omissions and misspellings outnumbered vowel errors as predicted from Experiment 1. Subjects did not omit vowels significantly in either conditon (stressed or unstressed syllables). Consonant errors accounted for 85% of all omissions and/or misspellings with allophones of /b/, /d/ and /g/ predominating in both conditions.

With regard to lexical stress, students tended to place the accent mark upon the appropriate tonic vowel. Errors in antepenultimate stress exceeded other stress degrees.

Table 1

Means and Standard Deviation for Word Stress Degrees

Condition/Correct Responses	M	SD
Antepenultimate	7.6	1.14
Penultimate	8.6	0.89
Postpenultimate (Final)	8.4	0.55

These results suggest that antepenultimate syllables tend to be confusing for some listeners because the tonic vowel is in a priority position followed by two atonic (unstressed) syllables. The investigator surmises that aural constraints operating within such words require more cognitive processing: the listener tends to code in his/her immediate memory the initial stressed syllable, yet allows subsequent vowels and consonants to blur. Another explanation of this phenomena may be that subtle alterations of normal stress patterns tend not to be conceptualized in many elementary Spanish learners. Learners become familiar with penultimate and final stress; students appear not to associate words with antepenultimate stress.

Conclusions and Suggestions for Further Research

The purpose of this study was to determine: (1) Was there a difference between initial, middle and final consonants spelled correctly by elementary Spanish students?; (2) Was there a difference between initial, middle and final vowels spelled correctly by elementary Spanish students?; and (3) Was there a difference between phonemes spelled correctly in stressed and unstressed syllables? Treiman et al. (1993) found that two hypotheses, intrinsic difficulty and context, operate in phoneme-grapheme mapping in American English.

It was hypothesized that the answers to the major questions of this investigation would not only identify serial position curves and lexical stress but also determine where intrinsic difficulties and context differences occur in Spanish learners. This investigation concluded:

1. Correct spelling of initial and final consonants were not significantly different for elementary Spanish learners.
2. Correct spelling of middle consonants were more difficult.
3. There was no significant difference between correct spelling of initial, middle and final vowels.

4. There was a significant difference only if alpha = .10 between the spelling of phonemes in stressed and unstressed syllables.

5. Spanish consonants in any position were more difficult to hear and spell than vowels.

6. The intrinsic difficulty and context hypotheses operated within phoneme-grapheme mappings in Spanish, thus validating previous research in American English (Blasdell and Jensen, 1970; Eilers, 1975; Jensen, 1962; Slobin, 1973; Treiman et al., 1993).

As a consequence of this investigation several suggestions for further research ensue.

1. Experimental research on the segmentation of phonemes in Spanish and its influence upon beginning student errors.

2. Asimilación homorgánica of the phoneme /m/ into allophones and its effect upon Spanish learners (see Zamora Munné and Guitart, 1982, p. 63-65).

3. Phoneme-grapheme mapping: allophones, position and tonic syllables in Brazilian Portuguese.

4. The serial position effect in French phoneme-grapheme mapping.

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